

WHAT IS CLAIMED IS:

1. Vacuum pumping apparatus comprising:

a scroll set having an inlet and an outlet, said scroll set comprising a stationary scroll element including a stationary scroll blade and an orbiting scroll element including an orbiting scroll blade, wherein said stationary and orbiting scroll blades are intermeshed together to define one or more interblade pockets;

a drive mechanism operatively coupled to said orbiting scroll element for producing orbiting motion of said orbiting scroll blade relative to said stationary scroll blade so as to cause said one or more interblade pockets to move toward said outlet;

a bellows assembly coupled between a first stationary component of said vacuum pumping apparatus and said orbiting scroll element so as to isolate a first volume inside the bellows assembly and a second volume outside the bellows assembly, wherein one end of said bellows assembly is free to rotate during motion of said orbiting scroll blade relative to said stationary scroll blade; and

a synchronization mechanism coupled between said orbiting scroll element and a second stationary component of said vacuum pumping apparatus and located within the first volume.

2. Vacuum pumping apparatus as defined in claim 1, wherein the bellows assembly comprises a bellows, a first flange sealed to a first end of the bellows and a second flange sealed to a second end of the bellows.

3. Vacuum pumping apparatus as defined in claim 2, further comprising a frame having a center hub, wherein the first flange is rotatably connected to the center hub.

4. Vacuum pumping apparatus as defined in claim 3, wherein the second flange is coupled to the orbiting scroll element.

5. Vacuum pumping apparatus as defined in claim 4, further comprising a bellows can sealed between the stationary scroll element and the first flange.

6. Vacuum pumping apparatus as defined in claim 2, wherein the bellows comprises a metal bellows.

7. Vacuum pumping apparatus as defined in claim 1, wherein the drive mechanism comprises a motor mounted at least partially inside the bellows assembly.

8. Vacuum pumping apparatus as defined in claim 4, wherein the synchronization
5 mechanism comprises three synchronization cranks, each coupled between said orbiting scroll element and a mounting plate affixed to the center hub.

9. Vacuum pumping apparatus as defined in claim 8, wherein the synchronization cranks are located at least partially inside the bellows assembly.

10. Vacuum pumping apparatus as defined in claim 8, wherein the synchronization cranks are located within an outer periphery of the stationary and orbiting scroll blades.

11. Vacuum pumping apparatus as defined in claim 1, wherein the bellows assembly is
15 configured to define a volume outside the bellows assembly that is isolated from the external environment and is configured to limit torsional stress on the bellows assembly during orbiting motion of said orbiting scroll blade relative to said stationary scroll blade.

12. A method for operating vacuum pumping apparatus of the type comprising a stationary
20 scroll element and an orbiting scroll element, said method comprising:

producing orbiting motion of said orbiting scroll element relative to said stationary scroll element;

coupling a bellows assembly between a first stationary component of the vacuum
pumping apparatus and the orbiting scroll element so as to isolate a first volume inside the
25 bellows assembly and a second volume outside the bellows assembly, wherein one end of said bellows assembly is free to rotate during motion of said orbiting scroll element relative to said stationary scroll element; and

coupling a synchronization mechanism between said orbiting scroll element and a second
stationary component of the vacuum pumping apparatus so as to synchronize said orbiting scroll
30 element and said stationary scroll element, wherein the synchronization mechanism is located within the first volume.

13. The method as defined in claim 12, wherein coupling the bellows assembly comprises providing a bellows, sealing a first flange to a first end of the bellows and sealing a second flange to a second end of the bellows.

5 14. The method as defined in claim 13, wherein the vacuum pumping apparatus includes a frame having a center hub and wherein coupling the bellows assembly comprises rotatably connecting the first flange to the center hub.

10 15. The method as defined in claim 14, wherein coupling the bellows assembly comprises coupling the second flange to the orbiting scroll element.

16. The method as defined in claim 15, wherein coupling the bellows assembly further comprises sealing a bellows can between the stationary scroll element and the first flange.

15 17. The method as defined in claim 12, wherein coupling the synchronization mechanism comprises locating the synchronization mechanism at least partially inside the bellows assembly.

20 18. The method as defined in claim 12, wherein coupling the synchronization mechanism comprises locating the synchronization mechanism within an outer periphery of the stationary and orbiting scroll elements.

25 19. The method as defined in claim 12, wherein coupling the bellows assembly comprises configuring the bellows assembly to define a volume outside the bellows assembly that is isolated from the external environment and to limit torsional stress on the bellows assembly during orbiting motion of the orbiting scroll element relative to the stationary scroll element.